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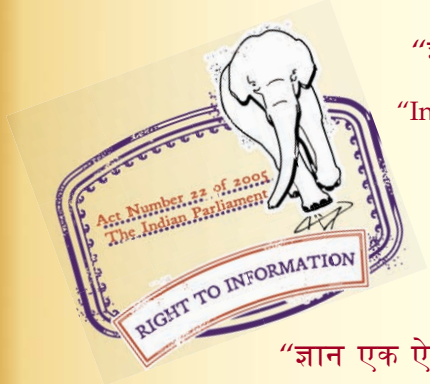

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Indian Standard

METHODS OF TEST FOR ABRASIVE PROPERTIES OF COAL AND ASSOCIATED MINERALS

(First Revision)

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NEW DELHI 110002

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Indian Standard

METHODS OF TEST FOR ABRASIVE PROPERTIES OF COAL AND ASSOCIATED MINERALS

(First Revision)

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METHODS OF TEST FOR ABRASIVE PROPERTIES OF COAL AND ASSOCIATED MINERALS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 25 November 1986, after the draft finalized by the Solid Mineral Fuels Sectional Committee had been approved by the Petroleum, Cold and Related Products Division Council.

0.2 Coal and specially associated minerals exhibit abrasive properties in varying degrees. Wear of vital parts of crushers, pulverizers and burning equipment, and coal mining and conveying machinery pose serious problems. It is, therefore, important to assess the relative abrasion characteristics of coal for selection of right type of equipment and material of constructian for mining, crushing, grinding and burning equipment.

0.3 The standard was published in 1981. The committee responsible for the prearation of this standard decided to undertake its revision in order to update the details of abrasion test apparatus and elaborate the test procedure.

0.4 The method described in this standard is based on a modified procedure developed at US Bureau of Mines and at the BCURA Industrial Laboratories, England.

0.5 In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated is to be rounded off, it shall be done in accordance with IS : 2-1960*.

1. SCOPE

1.1 This standard specifies the method for determination of relative abrasion characteristics of coal including lignite and associated minerals.

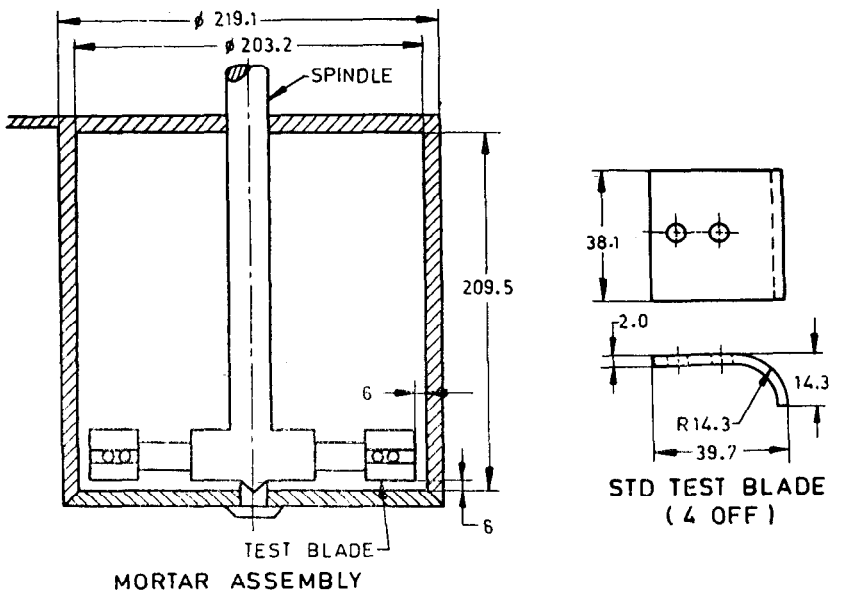
*Rules for rounding off numerical values (*revised*).

2. TERMINOLOGY

2.0 For purpose of this standard, the following definitions shall apply.

2.1 Air Dried Coal — The test sample of coal which is exposed to the atmosphere to bring it in equilibrium with the humidity conditions prevailing in the laboratory to avoid loss or gain of mass during weighing.

2.2 Abrasion Index (A. I.) — The mass of material loss expressed in mg/kg of coal when four standard metal blades (*see* Fig. 1) rotated in a known mass of coal of specified size under a given set of conditions.



All dimensions in millimetres.

FIG. 1 ABRASION TEST APPARATUS

3. PRINCIPLE — Abrasion index is calculated as the loss in mass of four blades resulting due to rotation in a known mass of coal under specified conditions.

4. APPARATUS

4.1 Sieves — Sieves of apertures 12·5 mm and 6·3 mm conforming to IS : 460 (Part 1)-1978*.

*Specification for test sieves: Part 1 Wire cloth test sieves (*second revision*).

4.2 Dimensions of Screw/Bolts — Screws used for fastening the blades with arms shall be of 4·7 mm diameter (2 *B A*) and 12·5 mm long. Two such screws shall be used for each of the four blades.

4.3 Abrasion Test Apparatus — The apparatus consists of a shaft of an overall length of 250 mm, diameter 19 mm and arm assembly to hold the wearing blades, a mortar that holds the test sample of coal and a drill press or a motor of 1·87 kW (2·5 hp) to provide rotation. The tentative dimensions are shown in Fig. 1. The mortar turned from extra strength pipe is 203·2 mm *ID* by 209·5 mm deep. A simple brass thrust bearing (SKEFKO Reference No. 6300 or equivalent Hoffman bearing) screwed through the bottom of the mortar supports and centres the shaft. Alternately, the pointed end of the shaft may be made to rest on a small groove at the bottom of the mortar. Adjustment of this bearing maintains a 6 mm clearance between the bottom of the mortar and bottom edge of the wearing blades. Four square bars fastened to the underside of the mortar bottom radially at 90° intervals fit into matching grooves in the table of the drill press to centre the mortar under the spindle of the drill press and prevent the mortar from rotating. A tight fitting detachable cover on the mortar is provided with a clearance hole for the rotating shaft. Four blades, 39·7 mm in length, 38·1 mm in breadth and 2·0 ± 1 mm in thickness made from mild steel are carried on four radial arms spaced 90° aprat (*see* Fig. 2). These arms are held in a hub on the shaft by set of screws. A clearance of 6 mm is maintained both between the blades and the bottom of the mortar and between blades and the wall of the mortar. The upper end of the shaft fits into the spindle of the drill press which is rotated by a motor of 1·87 kW to 2·25 kW (2·5 to 3·0 hp) at 1 450 rpm. A revolution counter to shunt off the motor after 12 000 revolutions, completes the abrasion apparatus. The blades shall be of hardness 150 ± 10 *VPN* and shall be machined from a bar of mild steel carbon content 0·28 to 0·32 percent.

NOTE — *VPN* and *BHN* in range of 150 to 200 shall be of the same order.

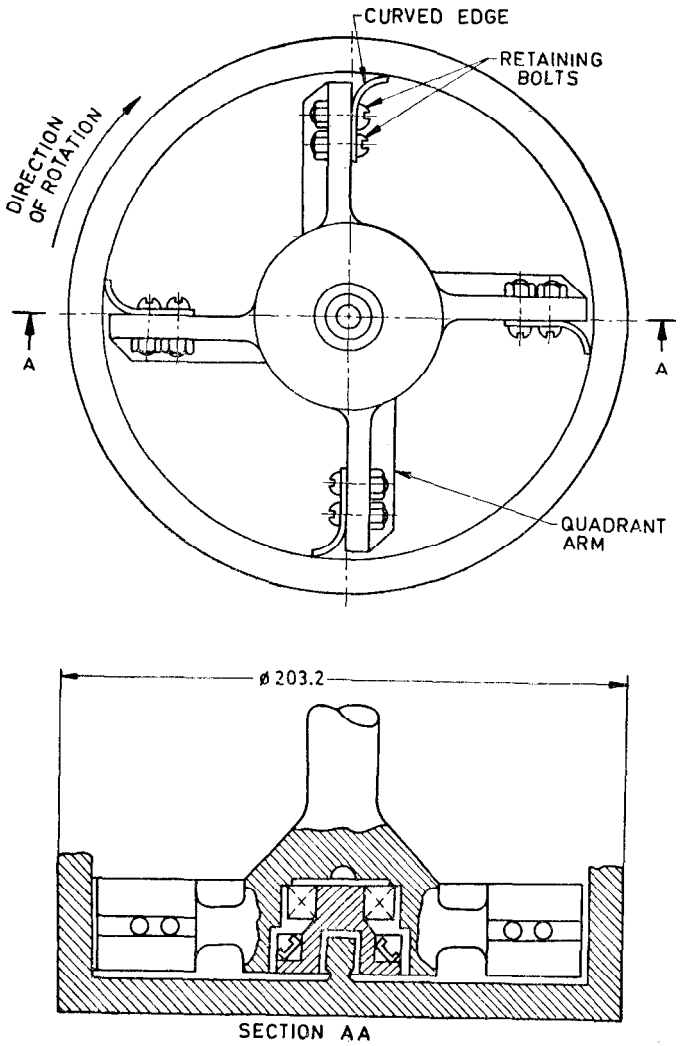
4.4 Balance — Two balances, one of 100 g capacity with a sensitivity of 0·00 1 g, and another of 10 kg capacity with 0·1 g sensitivity.

5. PREPARATION OF SAMPLE

5.1 The method for drawing and preparation of a representative coal sample shall be followed as prescribed under IS : 436 (Part 1/Sec 1)-1964* and IS : 436 (Part 1/Sec 2)-1976†.

*Methods for sampling of coal and coke: Part 1 Sampling of coal, Section 1 Manual sampling (*revised*).

†Methods for sampling of coal and coke: Part 1 Sampling of coal, Section 2 Mechanical sampling.



All dimensions in millimetres.

FIG. 2 POSITIONING DEVICE

5.2 The gross sample shall be reduced in stages first to pass through 12·5 mm screen and then through a sieve of aperture 6·3 mm. About 10 kg of sample thus prepared shall be spread on a suitable tray and kept exposed to the atmosphere for 24 hours.

6. PROCEDURE

6.1 Take out the four blades from the arms and put them into a beaker containing acetone so that blades are completely dipped into acetone. After sometime take out the blades, dry them by rubbing with glass-wool or clean with a piece of flannel and keep in a calcium chloride desiccator for five minutes. Then accurately weigh the four blades separately to the nearest milligram and fit them in the four arms of the shaft with its curved edge and round head of the retaining screws facing the direction of rotation. Fit the shaft to the thrust bearing. Weigh accurately $2 \pm 0{\cdot}001$ kg of thoroughly mixed air dried sample and transfer to the mortar cleaned of all material from the previous test.

6.2 After the rotating period (approximately 8 minutes) remove the blades and clean them with acetone as described in **6.1** and dry in a desiccator for about five minutes. Then weigh the blades separately to the nearest milligram. A damaged blade or one with apparently roughened surface should be replaced immediately. The blades may be rejected after they suffer a loss of one gram or after completing 35 tests whichever is earlier. A new set of blades will always be smoothened by Avery paper (sand paper) and then perform a pre-run by the operation of the apparatus in a charge of coal of known abrasion index.

7. CALCULATIONS

7.1 Record the initial mass of the four blades (designated S_1, S_2, S_3 and S_4) as M_1, M_2, M_3 and M_4 and final mass of the corresponding blades as M_1', M_2', M_3' and M_4'. The loss in mass due to abrasion of the four blades are ($M_1 - M_1'$), ($M_2 - M_2'$), ($M_3 - M_3'$) and ($M_4 - M_4'$)' respectively. Report the total loss of the four blades in milligram. So loss due to the abrasion $M = (M_1 - M_1') + (M_2 - M_2') + (M_3 - M_3') + (M_4 - M_4')$ expressed in mg.

The value of abrasion index is the average loss in mass of three independent tests expressed in mg per kg of sample taken for each test.

$$\text{Abrasion Index (A. I.)} = \frac{\overline{M}}{2} \text{ mg/kg}$$

where

$\bar{M}$ = average loss in mass (M) in mg in three independent tests.

7.2 Repeatability — The values of abrasion index for triplicate determination shall agree within 5 mg/kg.